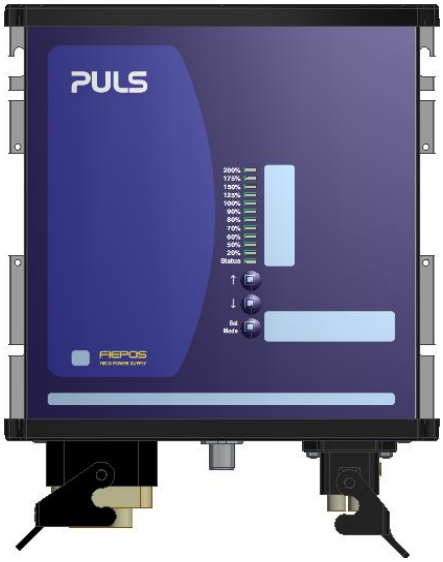
SEMI F47
Voltage Sag Immunity Test Report
for
Power Supply FPT500.48b-ccc-ddd



Other devices covered by this report:

FPT500.48b-ccc-ddd Three phase input, 500 W output

b:	1	Standard version, single output, output voltage adjustable
	2	Standard version, single output, output voltage not adjustable
	5	Version with up to 4 adjustable outputs, individually current limited
	6	Version with up to 4 adjustable “NEC CLASS 2” limited power source outputs
	7	Version with up to 4 combined regular and “NEC CLASS 2” limited power source outputs, adjustable output voltage
ccc:	001-999	Defines the connection terminal module
ddd:	101-999	Defines product variant (consecutive number)

SEMI F47 Test Report

Document number	FPT500.48x Semi F47 Rev1
PCTM number	-
Standards	**SEMI F47-0706** (July 2006) SPECIFICATION FOR SEMICONDUCTOR PROCESSING EQUIPMENT - Voltage Sag Immunity Compliance Tests **IEC 61000-4-11** 2004 +A1:2017 Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase
Applicant	PULS GmbH Elektrastraße 6 81925 Munich, Germany
Test Laboratory	PULS Vario GmbH Kranichberggasse 6 1120 Vienna, Austria
Test Engineer	Thomas Ramel
Test Date	22.05.2025
Description of Test Device:	Stand-alone power supply
Devices under Evaluation:	FPH500.241-002-101 Input: 3AC 380-480V, Output: DC 48-56V, 500W
S/N of Devices:	FPT500.481-008-103: S/N: 25 819 610
Application Details:	Input voltage: 3-Phase AC 400V Input frequency: 50 or 60Hz Output load: 500W

PASS/FAIL Criterions:	In accordance with paragraph 7.8.2 a) of SEMI F47-0706 The output voltage is not allowed to deviated more than 5% of the initial value. DC OK contact is not allowed to trigger during and after the test.
Test Result:	**PASS** The test device passed all essential SEMI F47-0706 tests according to the defined application details without any limitations and is qualified to bear the following approval mark:  Since DC power supplies, as covered in this test report, are only components of a semiconductor processing equipment, the tests of the SEMI F47 standard were conducted with selected rated characteristics of the DC power supply. The system integrator of the final semiconductor processing equipment needs to judge if the results of this test report are compatible with the SEMI F47 requirements of his system or if test data under other operating conditions are additionally required. The system integrator also needs to judge if the results of the inrush current peaks are compatible with the selected external fuses for input protection. The system integrator also needs to be aware about aging effects. It is expected that the ride through time can be reduced by 15% at end of the specified lifetime expectancy. A SEMI F47 certificate is not intended for this type of component, however the product fulfils the general requirements and can be marked with the symbol above.
Approved	Harald Etlinger Head of Product Compliance PULS Vario GmbH, Vienna
Date of Approval	**18.06.2025**

Copy of marking plate

List of Test Equipment

Type	Model	Inventory number
Test generator	Itech IT7806-350-90	10598
Load	Hewlett Packard 6051A	10034
Oscilloscope	Siglent SDS3034X HD	10564
Oscilloscope	Siglent SDS3034X HD	10566
Differential Probe	pico TA041	10519
Differential Probe	LeCroy AP031	10259
Differential Probe	Testec Elektronik GmbH SI 9001	10336
Current Probe	LeCroy CP150	10290
Current Probe	LeCroy CP150	10413
Current Probe	LeCroy CP150	10411

The test equipment complies with the requirements of IEC 61000-4-11.

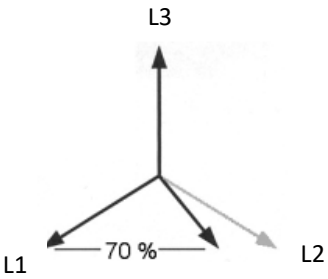
The peak current capability of the test generator was evaluated according Annex A of IEC 61000-4-11 and is able to deliver minimum 30A.

Test Specification for SEMI F47 compliance

Voltage Sag Immunity according to the following table:

Sag depth#1	Duration	Duration at 50 Hz	Duration at 60 Hz
50%	200ms	10 cycles	12 cycles
70%	500ms	25 cycles	30 cycles
80%	1000ms	50 cycles	60 cycles

#1 Sag depth is expressed in percent of remaining nominal voltage. For example, during a 70% voltage sag on a 200 volt nominal system, the voltage is reduced during the sag to 140 volts and not 60 volts.
At three-phase systems, without neutral conductor, the sag is applied on one phase-to-phase pair.

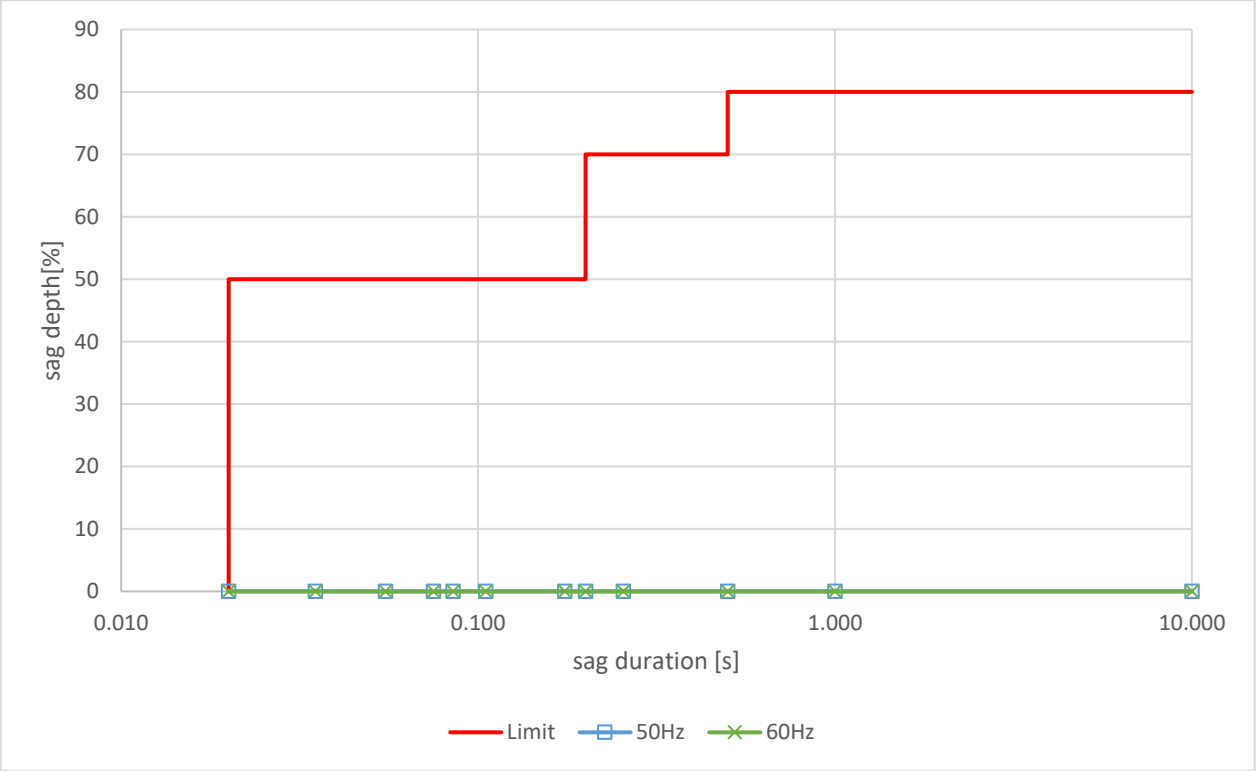


Test Setup

The unit under test in normal operating condition is mounted in a climate chamber.
The input is connected to an AC Source. The input voltage is measured with a 100:1 differential probe and the input current is measured with a current probe. These probes are connected to oscilloscope.

The output is connected to an active load. The output voltage is connected directly to the oscilloscope.
"DC-OK" signal is monitored with a logicanalyzer.

Voltage Sag Results L1-L2 @ 400VAC; 48VDC/10.42A



For all Sag times the voltage can be reduced to 0V without any influence on the output.

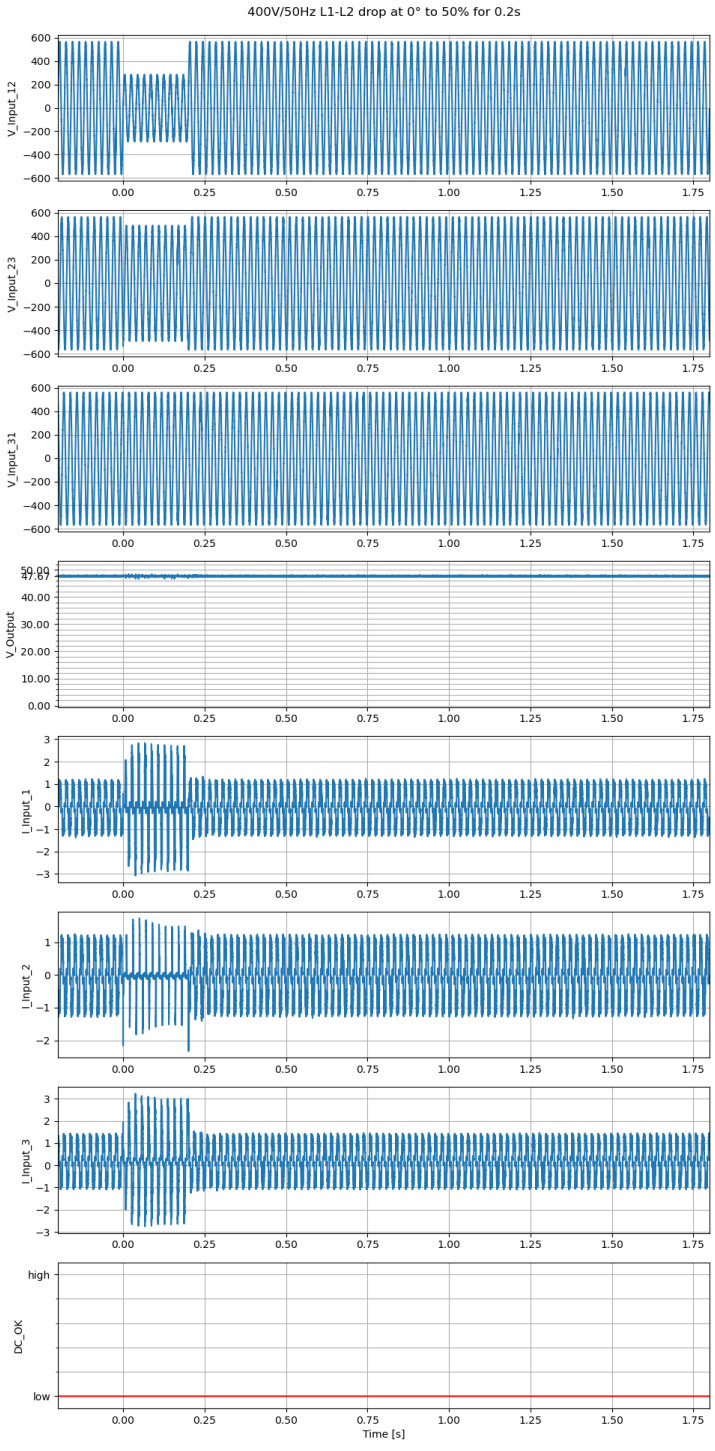
Conducted Tests at 400V 50Hz

Input voltage	400Vac
Input Frequency	50Hz
Sag	L1-L2
Output voltage	48V
Output current	10.42A
Ambient temperature	25°C

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.020	0	2.93
0.200	50	3.24
0.500	70	2.81
1	80	2.47
10	80	2.44

Informational measurements:

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.020	0	2.95
0.035	0	3.46
0.055	0	3.82
0.075	0	4.20
0.085	0	4.47
0.105	0	4.45
0.175	0	4.28
0.200	0	4.07
0.255	0	4.13
0.500	0	4.08
1	0	4.20
10	0	3.87



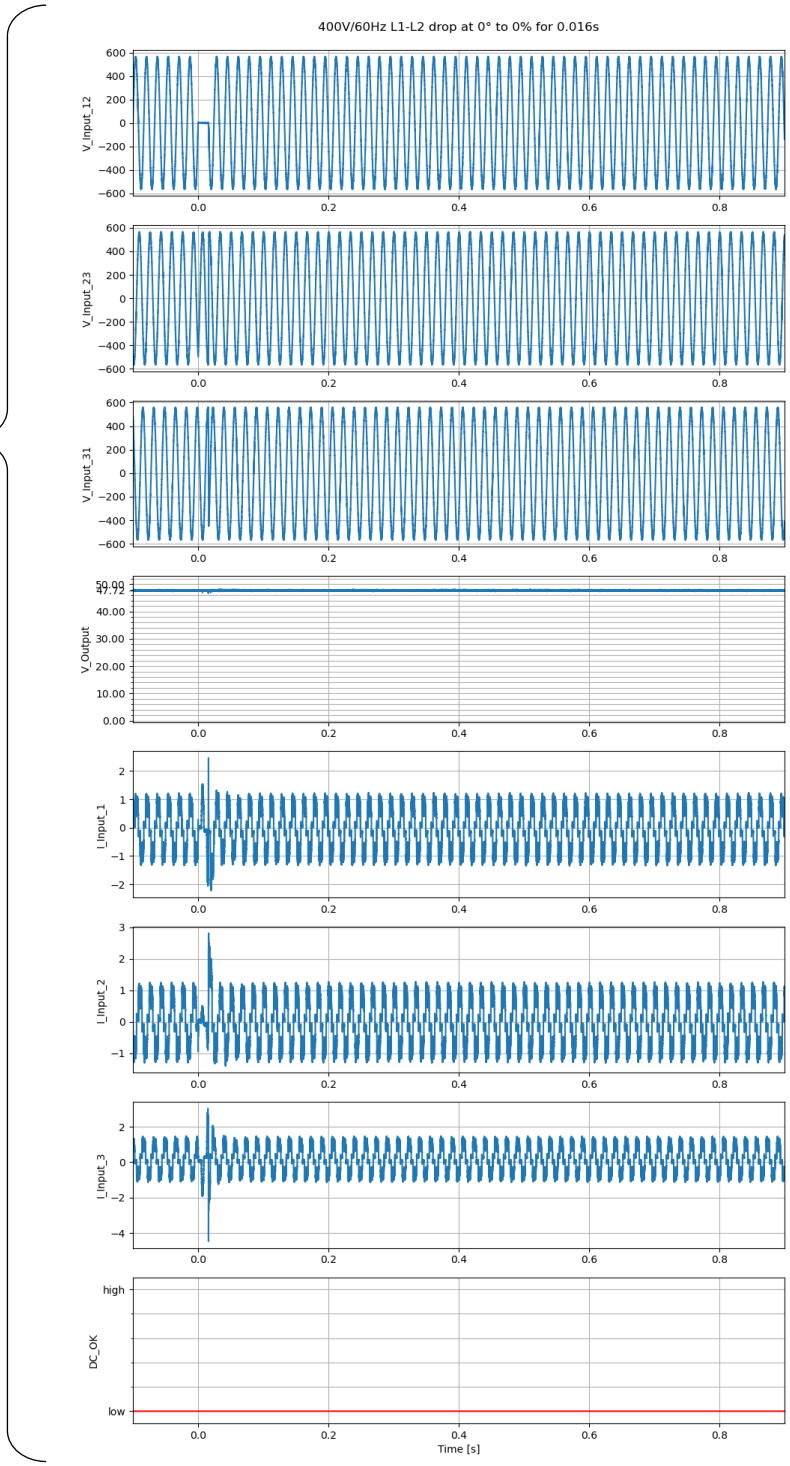
Conducted Tests at 400V 60Hz

Input voltage	208Vac
Input Frequency	60Hz
Sag	L1-L2
Output voltage	48V
Output current	10.42A
Ambient temperature	25°C

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.016	0	4.47
0.200	50	3.40
0.500	70	2.88
1	80	2.47
10	80	2.48

Informational measurements:

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.016	0	4.46
0.035	0	3.13
0.055	0	4.52
0.075	0	4.58
0.085	0	3.88
0.105	0	4.92
0.175	0	4.55
0.200	0	4.26
0.255	0	4.38
0.500	0	4.32
1	0	3.98
10	0	4.01



Inrush current measurements according 61000-4-11 at 400V 50Hz

Input voltage	400Vac
Input Frequency	50Hz
Output voltage	48V
Output current	10.42A
Ambient temperature	25°C

Peak input current measurements on unit under test:

First two measurements turn off input power for EUT for 5 minutes and then

Measure peak input current when AC turned on at 90°: 2.1 A

Measure peak input current when AC turned on at 270°: 2.0 A

Next two measurements turn on the input power for EUT for at least 1 minute then turn off input power for 5s and on again.

Measure peak input current when AC turned on at 90°: 2.1 A

Measure peak input current when AC turned on at 270°: 1.9 A

Inrush current measurements according 61000-4-11 at 400V 60Hz

Input voltage	400Vac
Input Frequency	60Hz
Output voltage	48V
Output current	10.42A
Ambient temperature	25°C

Peak input current measurements on unit under test:

First two measurements turn off input power for EUT for 5 minutes and then

Measure peak input current when AC turned on at 90°: 2.1 A

Measure peak input current when AC turned on at 270°: 2.0 A

Next two measurements turn on the input power for EUT for at least 1 minute then turn off input power for 5s and on again.

Measure peak input current when AC turned on at 90°: 2.1 A

Measure peak input current when AC turned on at 270°: 2.0 A

Operating conditions and their influence in test results:

a) Ambient temperature:
Control measurements show that the ambient temperature has only a minor influence in the ride-through time test results.
Depending on the used topology to reduce the input inrush current, the ambient temperature can have a major influence in the arising peak current after the sag test. Therefore, tests were performed at ambient temperatures of 25°C and +60°C.
It is assumed that semiconductor processing equipment is never used at lower temperatures than +25°C. Although the power supply itself is specified down to -25°C, a test at such low temperatures is not performed.

b) Mains frequency 50Hz vs. 60Hz:
Control measurements show that 50Hz testing is more critical than 60Hz testing.
Therefore, unless otherwise noted, all tests were performed with a mains frequency of 50Hz.

c) Output voltage 48V vs. 56V:
The ride-through time depends on the stored energy in the input capacitors and the amount of output power. The output voltage is not essential as long as the output power is constant.
The adjusted output voltage has no influence in input currents peaks after input voltage sags.
Therefore, unless otherwise noted, all tests were performed with an output voltage of 48Vdc.

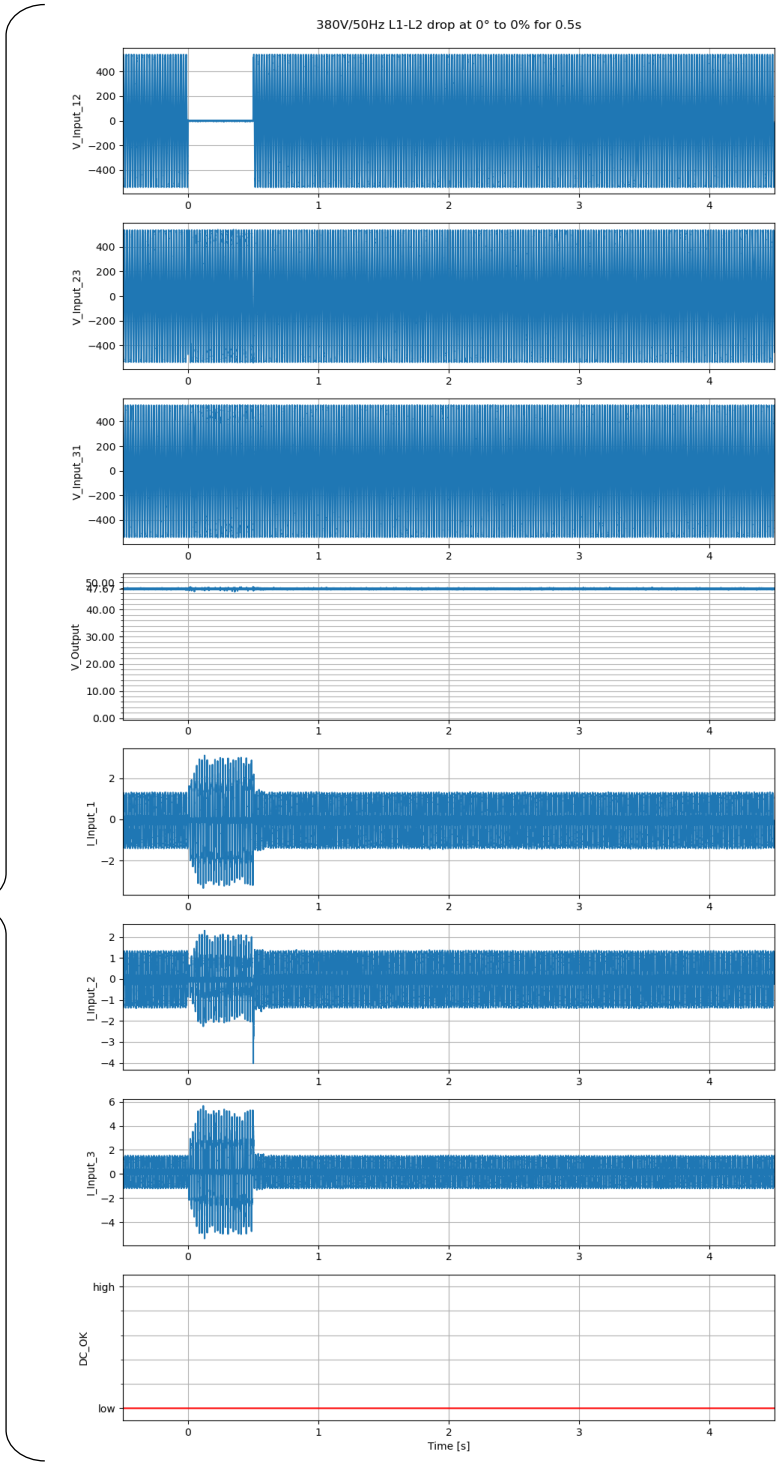
APPENDIX

Informational measurements at 380V

Input voltage	380Vac
Input Frequency	50Hz
Sag	L1-L2
Output voltage	48V
Output current	10.42A
Ambient temperature	25°C

Informational measurements:

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.020	0	2.94
0.035	0	3.69
0.055	0	4.51
0.075	0	5.24
0.085	0	5.32
0.105	0	5.32
0.175	0	5.59
0.200	0	5.52
0.255	0	5.61
0.500	0	5.66
1	0	5.31
10	0	5.47



Informational measurements at 480V

Input voltage	480Vac
Input Frequency	50Hz
Sag	L1-L2
Output voltage	48V
Output current	10.42A
Ambient temperature	25°C

Informational measurements:

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.020	0	2.67
0.035	0	4.09
0.055	0	4.01
0.075	0	4.01
0.085	0	4.53
0.105	0	4.25
0.175	0	4.40
0.200	0	2.76
0.255	0	4.41
0.500	0	2.71
1	0	2.67
10	0	2.69